GRASS GROOMING BRUSH APPARATUS

This invention relates to a grass grooming brush apparatus which is intended to be coupled with a propelling vehicle and which has a frame, a set of brushes mounted on the frame, and a wheel set mounted on the frame and adjustable between a ground-engaging position suitable for wheeled transport of the apparatus, and a raised position allowing the set of brushes to be engageable with the ground to brush or "groom" the surface thereof.

BACKGROUND TO INVENTION

One example of such apparatus is disclosed in more detail in US 5833013, to which attention is drawn.

The present invention develops apparatus of this known type and provides in addition a pair of wing frames each mounted on an adjacent side of a central or main frame and carrying its own set of brushes. Each wing frame is capable of being folded between an operative position in which its brush set engages the ground, and a raised transport position, thereby providing a reduced overall width of the apparatus for transport purposes. In the operative position of the main frame and the wing frames, a supporting wheel set is adjusted to a raised position with respect to the frames.

The present invention has been developed primarily with a view to automate the folding and unfolding of the wing frames, simultaneously with adjustment of the supporting wheel set.

SUMMARY OF INVENTION

According to the invention there is provided a grass grooming brush arrangement which can be coupled with a propelling vehicle and which comprises:

a central main frame carrying a set of brushes;

a pair of wing frames each mounted on an adjacent side of the main frame and carrying its own set of brushes;

first adjustment means connecting each wing frame to the main frame for folding movement between an operative position and a raised transport position of reduced overall width of the apparatus;

a supporting wheel set arranged to support the main frame;

second adjustment means mounting the wheel set on the main frame for movement between a ground-engaging transport position of the apparatus, and a raised operative position of the apparatus allowing the brush sets to carry out brushing operations on the ground; and

drive means coupled with the first and second adjustment means and operative to adjust the wheel set at the same time as the wing frames are adjusted.

Preferably, a single drive means provides simultaneous adjustment of the wheel set and of the wing frame.

In a preferred arrangement, a mechanism may be provided that utilises an electrically operated ram and which, by acting through a series of cables and pulleys enables the wing frames to be folded to the transport position, at the same time as the wheel set is lowered to a ground-engaging position in which the brush set of the main frame is lifted out of contact with the ground. Thus, the assembly becomes ready for moving from one area on site to another, without the driver of the propelling vehicle having to leave his seat.

Therefore, a grass grooming brush apparatus according to a preferred embodiment of the invention can carry out maintenance of golf "greens" in which it is desirable to brush the surface of the greens for such reasons as the brushing-in of a sand top dressing, or the dispersion of dew, or to stand the grass up before mowing to facilitate an even cut.

As it is highly desirable to avoid disruption of play, it is desirable to produce as wide a brushing action as possible, within the limits of practical manoeuvrability.

The invention, therefore, is an improvement on existing grooming apparatus, adding a pair of folding, preferably pivoted wing "brushes" which can move separately of the main central brush section, thus enabling them to conform to the contour of the surface, and to fold upwards and inwards to a transport position and thereby reduce the overall width of the apparatus.

By means of the invention, extension or retraction action of an actuator (which is a preferred form of drive means to move the transport wheels between lowered and raised positions) is converted into a lateral lifting or lowering force to move the wing brush frames between the operative position and the transport position at the same time as the transport wheels are adjusted.

While it is preferred that a single drive means provides the power to adjust all of the components, it is within the scope of the invention to provide two or more separate actuators, e.g. electric or hydraulic actuators.

A preferred embodiment of the invention will now be described in detail, by way of example only, with reference to the accompanying drawing.

BRIEF DESCRIPTION OF DRAWING

Figure 1 is a perspective illustration from above of a grass grooming apparatus according to the invention and showing in schematic form a drive means for adjusting the apparatus between an operative grass grooming position and a transport position of reduced width; and

Figure 2 is a schematic illustration of a detailed part of a transmission of an actuating force to adjust the apparatus between the operative position and the transport position.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring now to Figure 1 of the drawings, a grass grooming brush arrangement according to the invention is designated generally by reference 10, and is intended to be coupled with a propelling vehicle and preferably by being towed behind a propelling vehicle (not shown) via a towbar 11, having a coupling hitch 12.

The apparatus has a central rectangular main frame 13 carrying a set of brushes, which in the illustrated embodiment comprises a number of separate brush sections 14, extending generally parallel to each other, and transversely of the direction of forward travel shown by arrow 15. The frame 13 is rectangular, comprising front and rear transverse beams 16 and 17 respectively, and laterally spaced side frame beams 18 and 19, extending parallel to the travelling direction 15. The drawbar 11 is coupled to the forward transverse beam 16 rigidly to allow the entire apparatus 10 to be towed behind the propelling vehicle. To allow the apparatus 10 to be towed in a reverse direction, mounting brackets 20 are provided on the rear transverse beam 17, and to which the drawbar 11 is secured after being demounted from its connection to the forward transverse support beam 16.

Two wing frames 21 are provided, each mounted on an adjacent side of the main frame 13, and carrying its own set of brushes 22. Each wing frame 21 also is rectangular and the wing frames are shown in Figure 1 in the laterally outwardly deployed position, in which the sets of brushes 22 engage the ground surface, e.g. a grass surface on a fairway or green on a golf course, in order to carry out a required "grooming" action. In the laterally outwardly deployed position, the wing frames 21 are capable of pivoting up and down about respective pivot mountings (not shown in detail) provided on the facing sides of the main frame 13 in order to allow variations in the contour of the ground surface, compared with the ground surface over which the main frame section 13 is travelling.

Each wing frame 21 is connected to the main frame 13 via a first adjustment means (described in more detail below) which allows the wing frame 21 to carry out folding movement from the operative position shown in Figure 1, to a raised transport position of reduced overall width of the apparatus (not shown).

A supporting wheel set is provided to support the main frame 13. The wheel set comprises a tandem arrangement of transport wheels 23 each mounted rotatably on a U-shaped mounting bracket 24 and the mounting brackets 24 being joined together by a connecting bar 25 which allows the mounting brackets 24 to be moved together during adjustment of the transport wheels 23 between a raised position shown in Figure 1, and a lowered transport position (not shown). Each mounting bracket 24 is pivotally mounted on a respective sub-frame of the main frame 13, each sub-frame comprising longitudinal struts 26 which are spaced apart laterally from each other to define a recess which allows movement of the respective transport wheel 23 between the raised position shown in Figure 1 and the lowered transport position. The sub-frame also includes mounting straps 27 connected to the beams 26, and on which the mounting brackets 24 are pivotally mounted.

In order to adjust the wheel set between the raised position shown in Figure 1 (the operative position of the apparatus) to the transport position, a drive means is provided, taking the form, in the illustrated embodiment, of a single actuator 27 which is mounted on a post 28 secured to the rear transverse beam 17, and of which the rod 29 of the actuator is pivotally connected to the upper end of an actuator arm 30. A pivot connection 31 is provided between the end of actuator rod 29 and the upper end of the actuator arm 30, whereas the lower end of the arm 30 is rigidly secured to the connecting bar 25 which is

coupled to the mounting brackets 24. Evidently extension or retraction movement of the actuator rod 29 will cause the brackets 24 to pivot and thereby raise or lower the transport wheels 23, i.e. extension of the rod 29 will raise the wheels 23 and retraction of the rod 29 will lower the transport wheels.

When the transport wheels 23 are in a raised position, this may be a completely raised position out of contact with the ground, in which case the entire weight of the apparatus bears on the ground via the brushes 14 and 22, to provide a vigorous brushing or "grooming" action. If it is desired to reduce the pressure contact between the brush elements and the ground, then the wheels 23 may be raised only a small distance from the transport position.

When it is desired to move the apparatus 10 from one site to another, it will often be the case that only narrow pathways are available, and therefore, when the wheels 23 are lowered to the transport position, it will be necessary to reduce the overall width of the apparatus, and which is achieved by upward folding movement of the wing frames 21. The manner by which this adjustment of the wing frames takes place simultaneously with adjustment of the wheels 23 will now be described.

There is therefore provided a coupling of the actuator 27 with the wing frame sections 21, whereby retraction of the rod 29 effects a pulling force on the wing frame sections 21 which then pivot upwardly from the operative position shown in Figure 1 to an upwardly extending transport position (not shown). In the illustrated embodiment, the coupling to the wing frames 21 is achieved by means of flexible tensile connections, which take the form of cables, coupled at one end to the upper end of actuator arm 30 and at their opposite ends comprise connections to the frame sections of wing frames 21. This is shown in Figure 1, in which the initial section of each tensile link is shown by reference A, and which is then taken round part of a pulley 32, and then runs to a connection point 33 on the frame of each wing frame 21. The length of flexible tensile link running between each pulley 32 and a respective one of the wing frames 21 is shown by references B and C in figure 1.

Evidently, extension or retraction of the actuator rod 29 will therefore cause simultaneous adjustment of the transport wheels 23 and the wing frames 21.

Accordingly, the preferred embodiment is a disclosure of one example in which a common drive means is provided which is coupled with first and second adjustment means

(associated with the wing frames 21 and the wheel set 23 respectively), such drive means being operative to adjust the wheel set at the same time as the wing frames are adjusted.

The flexible tensile links between the actuator arm 30 and the connection points 33 on the wing frames 21 are shown schematically only in Figure 1. In practice, the pulleys 32 will be mounted on a fixed part of the general frame of the apparatus, such frame being coupled rigidly to, or forming part of the main frame 13.

Figure 2 is a schematic plan view illustration showing the pulleys 32 mounted on a frame component 34 of part of the main or fixed frame of the apparatus.

The actuator 27 may comprise a hydraulic or pneumatic ram, but evidently other arrangements of actuator may be provided, in order to apply required turning movement to the actuator arm 30 and also to apply a pulling force, or release pulling force on the tensile links to the frame sections 21 (which then allows the wing frames to lower themselves to the operative position under the action of gravity).

Evidently, other mechanical connection means may be provided to transmit linear movement of the actuator 27 into pivotal movement (up or down) of the wing frames 21.